can be surmounted, it may ultimately be possible to connect Australia with the East Indies and so with Asia.

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TWO NEW BASE MAPS OF THE UNITED STATES

AN outline base map of the United States on the Lambert Zenithal equal area projection, scale 1–7,500,000, dimensions 19¾ inches by 25¾ inches, price 15 cents, has just been issued by the Coast and Geodetic Survey.

The map covers the whole of the United States, including the northern part of Mexico. Only state names and boundaries, principal rivers, capitals, and largest cities are shown, the chief object being to furnish a base map for political, census, or statistical purposes on a projection in which the property of equivalence of area is one of the essential features. It is the first publication of a projection of this type by the Coast and Geodetic Survey.

The two errors, to one or both of which all map projections are liable, are change of area and distortion, as applying to portions of the earth's surface. Errors of distortion imply deviation from right shape in the graticules or network of meridians and parallels of the map, involving deformation of angles, curvature of meridians, changes of scale, and errors of distance, bearings, or area.

In the mercator projection as well as in the Lambert Conformal Conic projection, the changes in scale and area can not truly be considered as distortion or as error. A mere alteration of size in the same ratio in all directions is not considered distortion or error. These projections being conformal, both scale and area are correct in any restricted locality when referred to the scale of that locality, but as the scale varies in latitude from point to point large areas are not correctly represented.

In the Lambert Zenithal projection the zenith of the central point of the surface to be represented appears as pole in the center of the map; the azimuth of any point within the surface, as seen from the central point, is the same as that for the corresponding points of the map; and from the same central point, in all directions, equal great circle distances to points on the earth are represented by equal linear distances on the map. The amount of scale error, as we depart from the center of the map radially, increases (scale becoming smaller), while in a direction at right angles thereto the scale is by the same amount too great.

For a distance from the assumed center of the map equal to 22 degrees of arc of a great circle, an extent embracing the whole of the United States, the maximum scale error is but one and seven eighths per cent. The amount of this error is less than one third of the scale error in a polyconic projection of the same area, while the direction errors (errors of angles and azimuths) are likewise considerably less than in the latter projection.

An outline base map of the United States on the Lambert Conformal Conic projection, scale, 1–5,000,000, dimensions, 25 by 39 inches, price, 25 cents, has also been issued by the Coast and Geodetic Survey. This map is similar to the one on the Zenithal Equal Area projection in general treatment. It is larger in scale, however, but embraces a lesser extent of latitude, being limited to the area of the United States, whereas the zenithal equal area map includes the greater portion of Mexico.

The map is of special interest from the fact that it is based on the same system of projection as that which was employed by the allied forces in the military operations in France.

The term *conformal* has been defined as follows: If at any point the scale along the meridian and the parallel is the same (not correct, but the same in the two directions) and the parallels and meridians of the map are at right angles to one another, then the shape of any very small area on the map is the same as the shape of the corresponding small area upon the earth. The projection is then called orthomorphic (right shape).

The value of this new outline map can best be realized when it is stated that throughout

the larger and most important part of the United States, that is, between latitudes 30½° and 47½°, the maximum scale error is only one half of one per cent. Only in southernmost Florida and Texas does this projection attain its maximum scale error of 2¼ per cent. This implies, however, an error in the areas at these extreme parts equal to the square of the linear distortion, or an error of 5¼ per cent.

While this error in area may be accounted for by methods already described, the Zenithal projection on the other hand is free from this inconvenience.

The choice then between the Lambert zenithal and the Lambert conformal for a base map of the United States, disregarding scale and direction errors which are conveniently small in both projections, rests largely upon the choice of *equal area* as represented by the Zenithal and *conformality* as represented by the Conformal Conic projection—the former property appealing directly to the practical use of the map, the latter property being one of mathematical refinement and symmetry with definite scale factors available, the projection having two parallels of latitude of true scale, the advantages of straight meridians as an element of prime importance, and the possibilities of indefinite east and west extension without increase of scale error.

SPECIAL ARTICLES

SUBSTITUTES FOR PHENOLPHTHALEIN AND METHYL ORANGE IN THE TITRATION OF FIXED AND HALF-BOUND CO_2[1]

During the past year the writer has had occasion to make a great many determinations of sodium carbonate in the presence of the hydrate by the double titration method with phenolphthalein and methyl orange as indicators. The end point with methyl orange was not satisfactory. A number of new indicators were tried with the result that two were found which may be used as substitutes for phenolphthalein and methyl orange.

[1] Published by permission of the Secretary of Agriculture.

An added advantage of these two indicators[2] is that both have the same color changes. Six drops of one indicator in 75 c.c. of solution gives a fairly deep blue in the presence of sodium hydrate and carbonate and on titration with hydrochloric acid retains this color until the hydrate is all neutralized and the carbonate converted into bicarbonate when it changes at the neutral point to a muddy green and then with a slight excess of acid to a lemon yellow. The addition of three drops of the second indicator will now change the solution to a deep blue, which continues until the bicarbonate has all been destroyed, when the solution shows the same intermediate change as before and becomes a lemon yellow again when a slight excess of acid is present.

These indicators are among the nine recommended by Clark & Lubs[3] for the colorimetric determination of hydrogen ion concentration. The first indicator, thymol blue (thymol sulfon phthalein) is prepared by introducing 1 decigram of the substance into a Florence flask and then adding 4.3 c.c. of $n/20$ sodium hydroxid. The solution is best heated by introducing the flask into hot water and agitating until the indicator is all dissolved. When solution is complete, the volume is made up to 250 c.c. with distilled water.

The substitute for methyl orange is brom phenol blue (tetra bromo phenol sulfon phthalein). This indicator is made up in the same way except that 1 decigram requires only 3.0 c.c. of $n/20$ sodium hydroxide.

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[2] These indicators may be obtained from Hynson, Westcott & Dunning, of Baltimore, Maryland.

[3] Clark, Wm. Mansfield, and Lubs, Herbert A., *Jour. of Bacteriology*, Vol. II., Nos. 1, 2 and 3.

THE AMERICAN SOCIETY OF ZOOLOGISTS

The American Society of Zoologists held its seventeenth annual meeting in conjunction with Section F of the American Association for the Advancement of Science and the Ecological Society of America, December 29, 30 and 31, in the Soldan High School building, St. Louis, Missouri. President C. M. Child presided throughout the